

# OPERATIONAL USE OF VIIRS MULTISPECTRAL IMAGERY AND NUCAPS SOUNDINGS IN SHORT-TERM WEATHER FORECASTING

KEVIN FUELL<sup>13</sup>, EMILY BERNDT<sup>23</sup>, ANDREW MOLTHAN<sup>23</sup>, AND  
LORI SCHULTZ<sup>13</sup>

<sup>1</sup>UNIVERSITY OF ALABAMA IN HUNTSVILLE

<sup>2</sup> NASA MARSHALL SPACE FLIGHT CENTER

<sup>3</sup>SHORT-TERM PREDICTION RESEARCH AND TRANSITION CENTER

AGU FALL MEETING

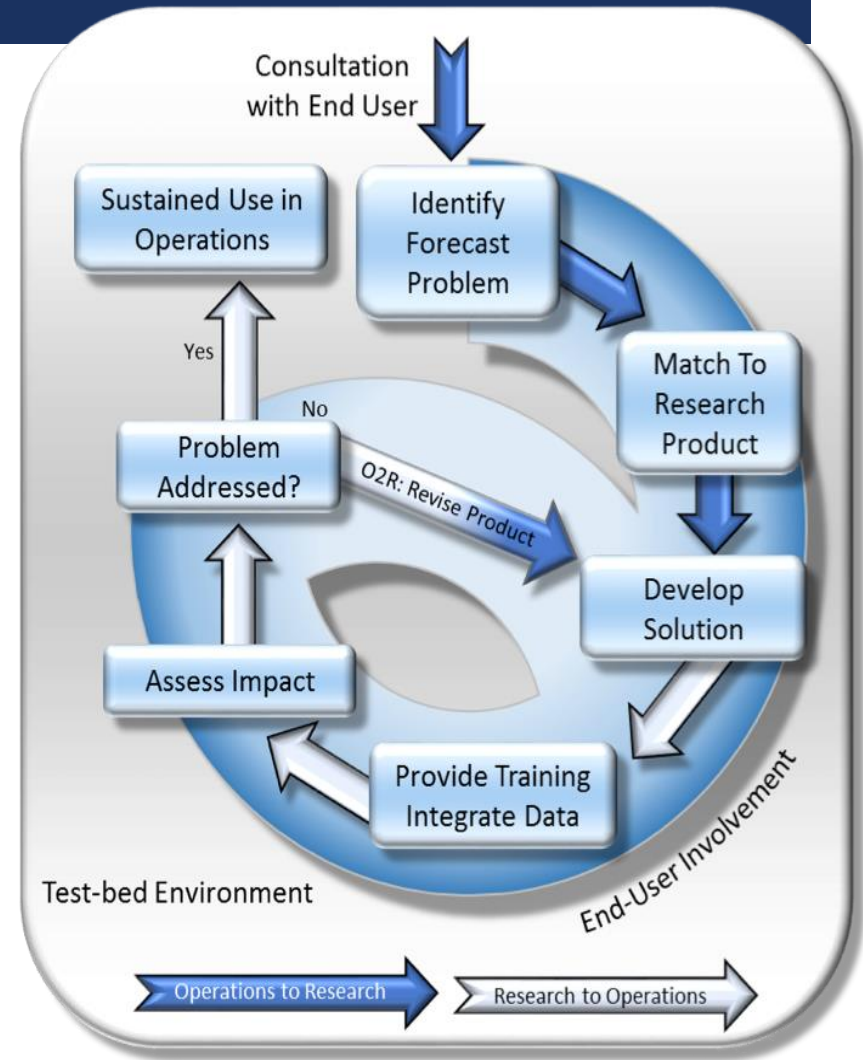
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Short-term Prediction Research and Transition Center

# SPORT MISSION AND PARADIGM

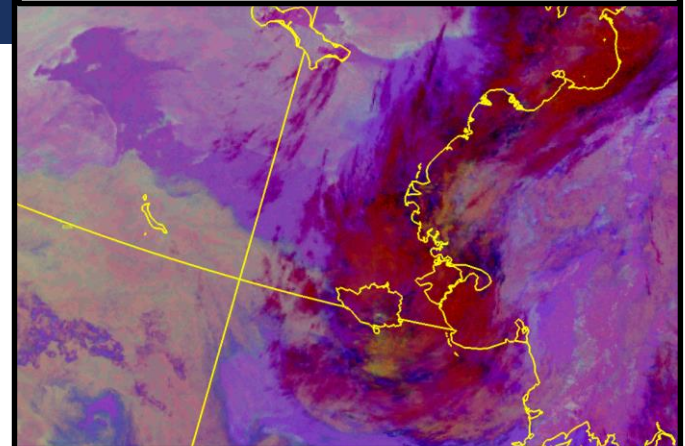
- ***Apply satellite measurement systems and unique Earth science research to improve the accuracy of short-term weather prediction at the regional and local scale***
- Bridge the “Valley of Death”
- Can’t just “throw data over the fence”
  - Maintain interactive partnerships with help of specific advocates or “satellite champions”
  - Integrate into user decision support tools
  - Create forecaster training on product utility
  - Perform targeted product assessments with close collaborating partners
- Concept has been used to successfully transition a variety of satellite datasets to operational users for nearly 10 years



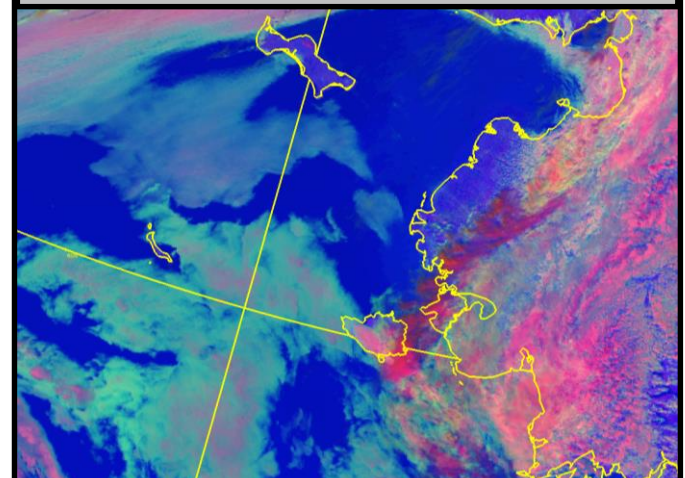
# PARTNERSHIP WITH THE JPSS PROVING GROUND

- SPoRT supports the JPSS Proving Ground through the transition of S-NPP VIIRS and CrIS/ATMS products to prepare users for the upcoming JPSS 1 & 2 missions
- Multispectral (i.e. RGB) imagery can be created from VIIRS based on internationally-accepted recipes developed by EUMETSAT to support forecasting aviation hazards
  - Night-time Microphysics
  - Day-time Microphysics
  - 24-hour Microphysics
  - Dust
  - Volcanic Ash
- CrIS/ATMS temperature, moisture, and ozone soundings processed through the NOAA Unique Combined Processing System (NUCAPS) algorithm can be used to anticipate rapid cyclogenesis or hurricane extratropical transition

Night-time Microphysics RGB (top)



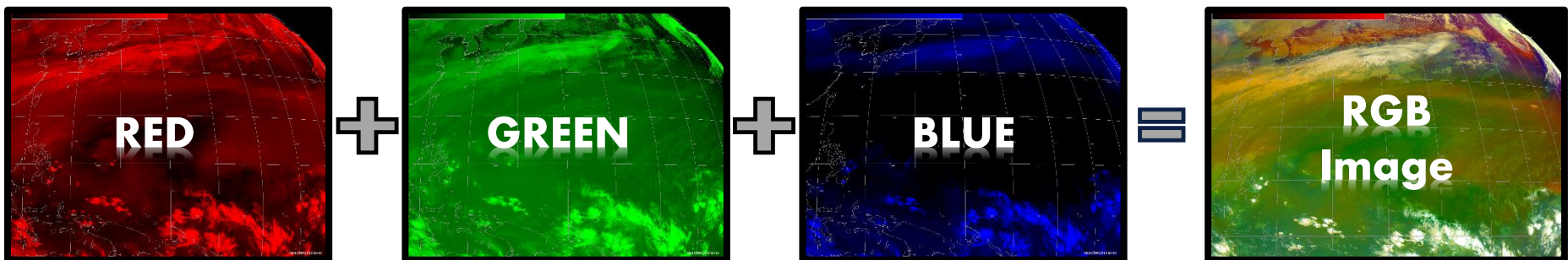
Tracking low clouds and fog from night to day in Alaska's Bering Sea with VIIRS



Daytime Microphysics RGB

# WHAT IS MULTISPECTRAL IMAGERY

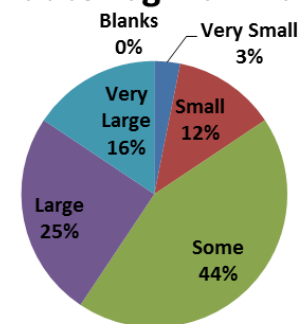
- Multispectral (i.e. RGB) imagery is the use of single channels or channel differences combined into each of the red, green, and blue color components, resulting in a false-color composite related to physical features
- The advantage of RGB imagery is the ability to look at a single image to identify a feature instead of analyzing multiple single channels
- RGB products are qualitative in nature are designed to enhance a specific phenomena such as low clouds and fog, dust, convection, air mass characteristics, or volcanic ash



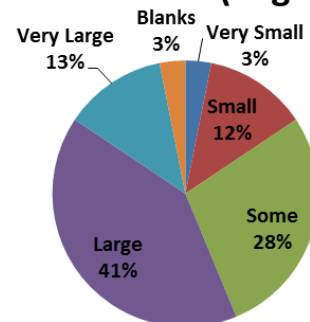
# END USER INTERACTION – LOW CLOUDS/FOG

- Initial transition of the Night-time Microphysics RGB to operations and winter 2013-2014 assessment with 4 NWS Western Region and Alaska WFOs revealed
  - improved distinction of low clouds and fog
  - improved short-term aviation and public forecasts

**Impact of NTmicro RGB to Differentiate Fog from Low Cloud**



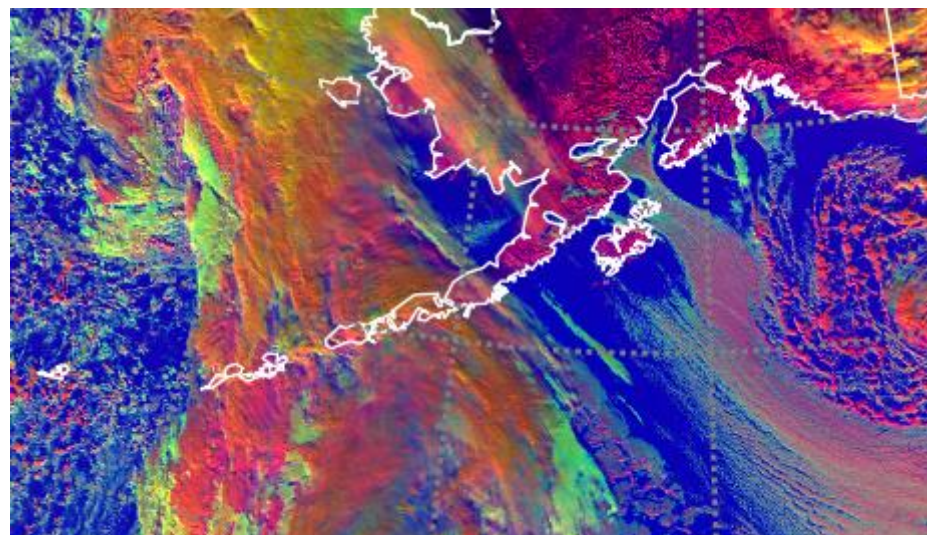
**Impact of NTmicro RGB to Aviation Forecast Issues (in general)**





# END USER INTERACTION – LOW CLOUDS/FOG

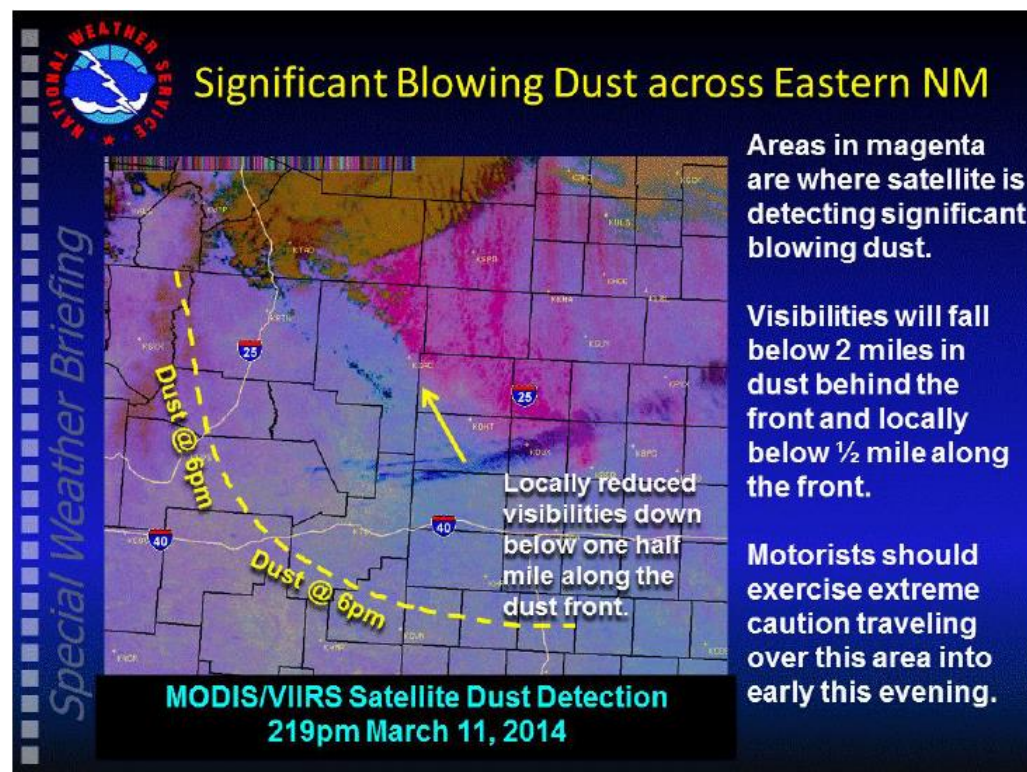
- An increased number of S-NPP passes at high latitude combined with other instruments led to a series of microphysical RGBs to be introduced to NWS Alaska Region WFOs
- Forecasters have access to the Night-time Microphysics derived from MODIS, VIIRS, and AVHRR in anticipation for the increased number of overpasses what will be available with JPSS 1 & 2
- The success of the Night-time Microphysics RGB led to transition of daytime compliments
  - 24-hour Microphysics RGB
  - Day-time Microphysics RGB



VIIRS Day-time Microphysics RGB in Alaska

# END USER INTERACTION - DUST

- SPORT introduced the Dust RGB to Albuquerque WFO in 2011
- Easier to track dust plumes from day to night and differentiate dust from clouds.
- Increased forecaster confidence in extent and density of dust plumes has led to better warning and advisory products.
- Use of a “Dust” RGB in the U.S. southwest led to changes in NWS forecast products due to improvements in detection and monitoring of dust aloft

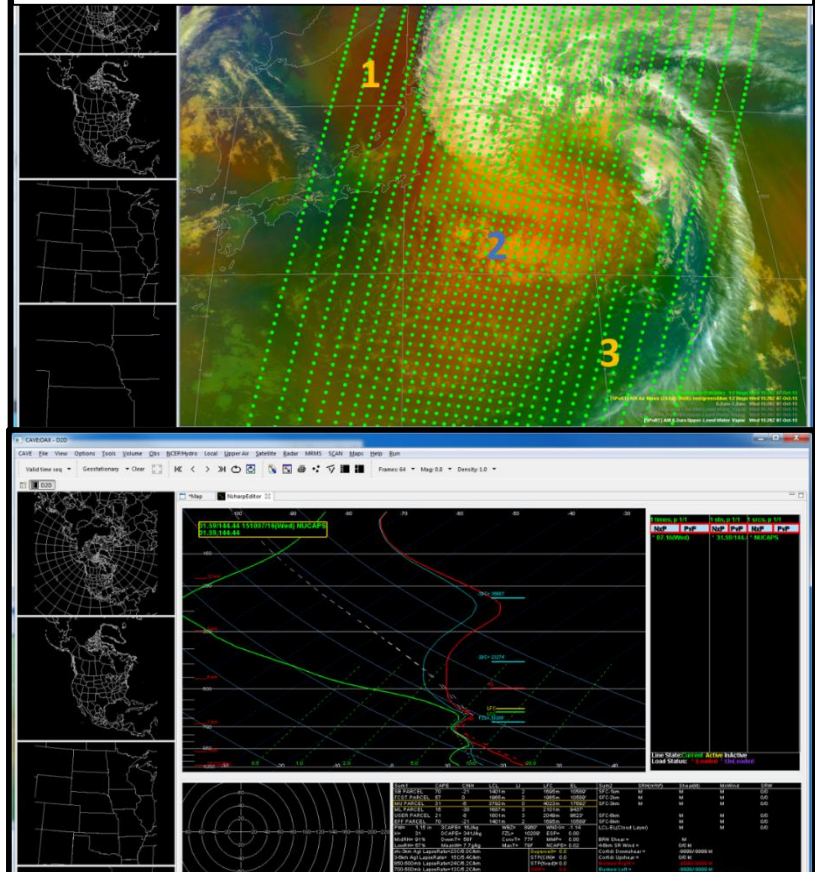


Fuell, K. K., B. J. Guyer, D. Kann, A. L. Molthan, and N. Elmer, 2016: Next generation satellite RGB dust imagery leads to operational changes at NWS Albuquerque. *J. Operational Meteor.*, **4**(6), 75–91.

# END USER INTERACTION – CYCLONES/HURRICANES

- CrIS/ATMS NUCAPS soundings can be used as a quantitative product to increase confidence in interpreting the Air Mass RGB
- The Air Mass RGB is used to identify dry air intrusions that can impact rapid cyclogenesis or hurricane extratropical transition but is limited to observing the mid-to upper levels of the atmosphere
- Satellite soundings can provide valuable information about the depth of moist or dry layers of the atmosphere
- NUCAPS Soundings are already available in AWIPS-2 for forecasters

Severe Tropical Storm Choi-wan Himawari-8 AHI 7 October 2015 1520 UTC Advanced Baseline Imager Air Mass RGB and NUCAPS Sounding point locations

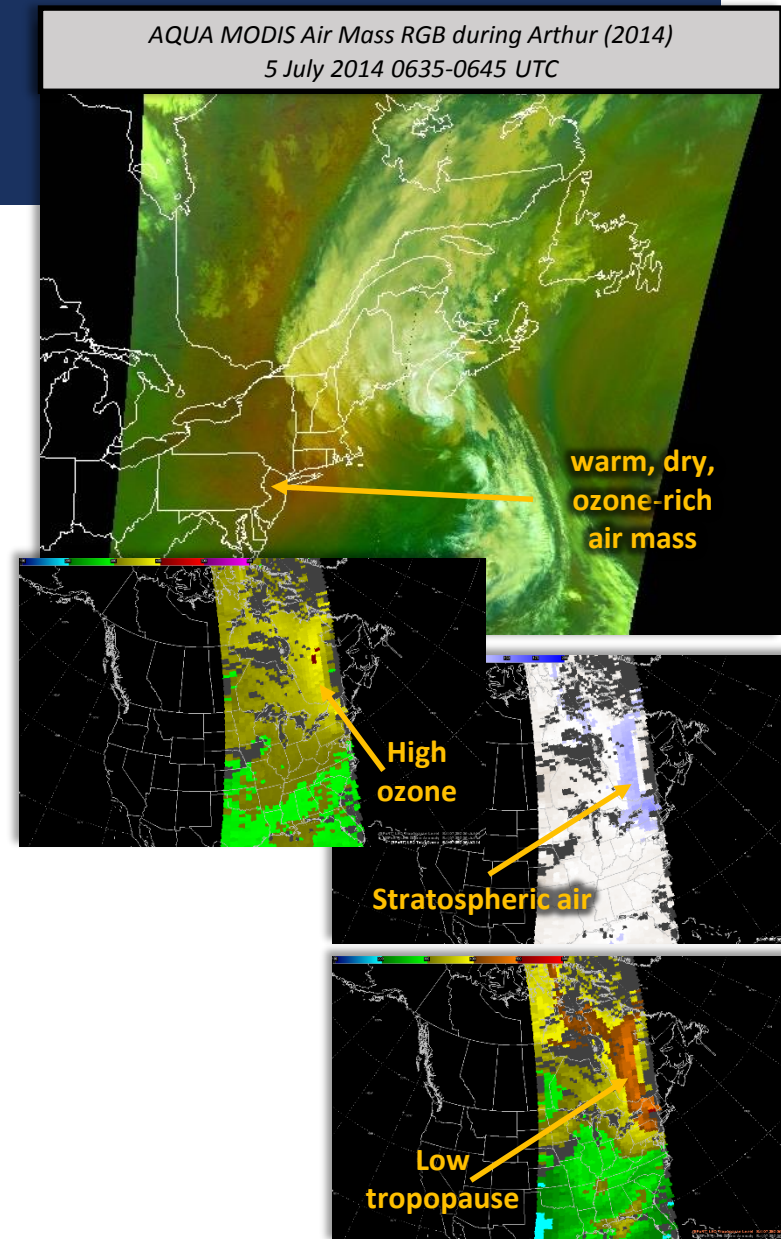


NUCAPS Sounding point locations 7 October 2015 1500 UTC taken near point 2 in a region of upper-level dry air (orange coloring) and mid-level clouds (light orange coloring)



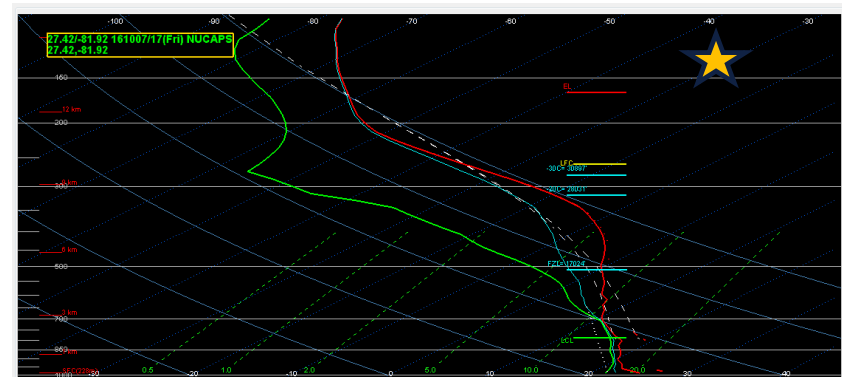
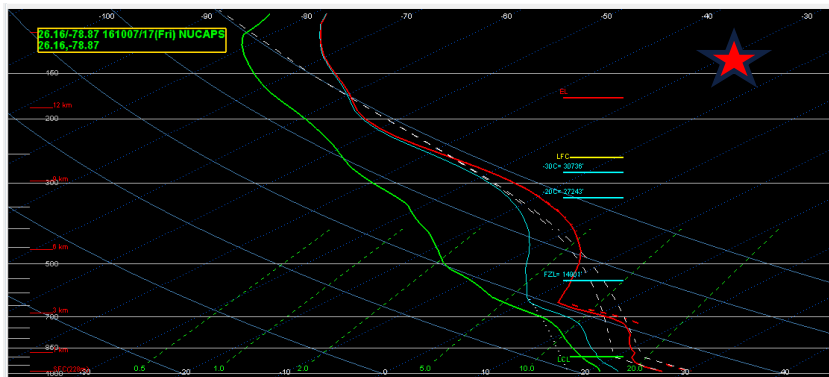
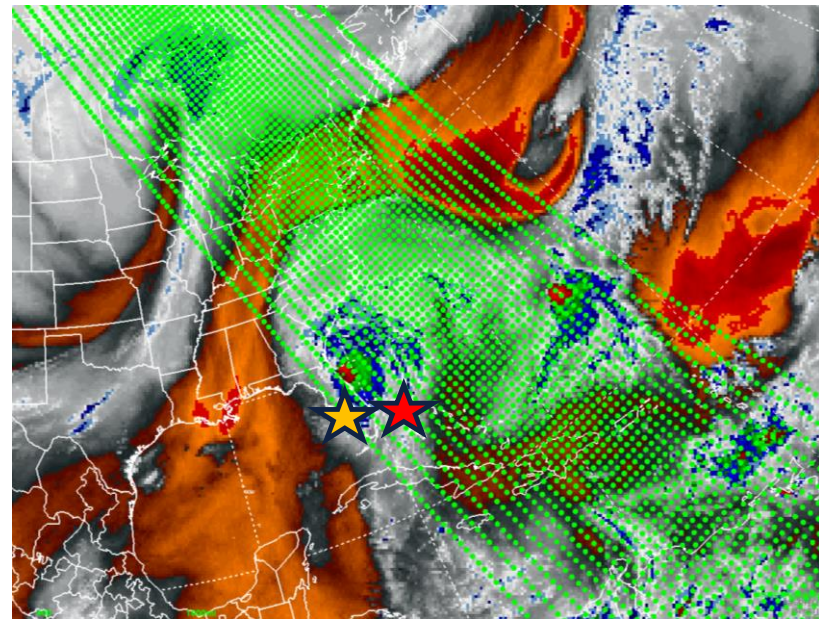
# END USER INTERACTION – CYCLONES/HURRICANES

- NUCAPS Soundings can be used to create plan view products to confirm the influence of warm, dry, ozone-rich stratospheric air in the near-storm environment
- AIRS Total Column Ozone was transitioned to NOAA/NWS National Centers in 2013 and products derived from NUCAPS in 2014
- Additional products such as Ozone Anomaly and Tropopause level were developed as quantitative compliments to the Air Mass RGB
- National Centers routinely use the SPoRT Ozone products and Air Mass RGB to anticipate rapid cyclogenesis and high winds/waves in the North Atlantic and Pacific



# END USER INTERACTION – CYCLONES/HURRICANES

- NUCAPS Soundings and SPoRT ozone products were introduced to National Hurricane Center and Tropical Analysis and Forecasting Branch forecasters for feedback during the 2016 hurricane season
- SPoRT is working on a post-analysis of Hurricane Matthew to discuss the utility of the JPSS products for extratropical transition and rapid intensification



# SUMMARY

- SPoRT has been engaged with the JPSS Proving Ground and NWS end users to introduce multispectral (i.e. RGB) imagery derived from S-NPP VIIRS to operations to forecasters for upcoming JPSS 1 & 2 missions
- RGB products designed for monitoring low clouds and fog, dust, and volcanic ash have had an impact on aviation forecasts in the Alaska Region as well as with other applications specific to WFOs and National Centers across the U.S.
- Development of targeted training and product assessments has led to RGB products being adopted into normal operations and routine use by forecasters
- SPoRT has worked with the JPSS Proving Ground to find new applications for CrIS/ATMS NUCAPS Soundings including identification of stratospheric air for anticipating rapid cyclogenesis and hurricane extratropical transition
- Quantitative ozone products were developed from CrIS/ATMS NUCAPS ozone soundings to assist forecasters with interpreting the Air Mass RGB

# QUESTIONS?

<http://weather.msfc.nasa.gov/sport/>

<https://nasasport.wordpress.com/>

[http://twitter.com/NASA\\_SPoRT](http://twitter.com/NASA_SPoRT)

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